DOCUMENT RESUME

ED 229 400 TM 830 294

AUTHOR Kose, Gary
TITLE Children's Conceptions of Spatial Relationships in Drawings and Photographs.
PUB DATE Apr 83
NOTE 15p.; Paper presented at the Annual Meeting of the American Educational Research Association (67th, Montreal, Quebec, April 11-15, 1983).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Child Development; Children; Cognitive Ability; *Cognitive Processes; *Concept Formation; *Depth Perception; Discrimination Learning; Freehand Drawing; Photographs; *Spatial Ability; *Visual Measures
IDENTIFIERS Cognitive Mapping; *Piagetian Tasks

ABSTRACT

This study concerns children's understanding of spatial relationships and their expression in drawings and photographs. Sixty children (ages 5, 8, and 11) were asked to discriminate and reproduce three types of depth relationships in either drawings or photographs: enclosure, where a larger object is placed directly behind a smaller object; occlusion, where one object is placed in front of and partially obscuring another object; and perspective, where two objects are completely in view but one object is placed behind and at a distance from the other. The findings indicate that reproduction is more difficult than discrimination in both media. When reproducing the depth relationships, overall, it was more difficult to reproduce them in photographs than in drawings. However, certain depth relationships are more easily reproduced in photographs, while others are more easily reproduced in drawings. The results are discussed in terms of how the characteristics of the medium access different aspects of conceptual understanding. (Author/PN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED229400

Children's Conceptions of Spatial Relationships in Drawings and Photographs

Gary Kose
Institute for Cognitive Studies
Rutgers University·
Newark Campus

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

G. Kose

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Paper presented in the Symposium on Educational Implications of Children's Acquisition of a Concept of Space. American Educational Research Association Annual Meetings, April 11-15, 1983, Montreal, Quebec, Canada.

TM 830 299

Abstract

This study concerns children's understanding of spatial relationships and their expression in drawings and photographs. Children five-, eight- and eleven-years-old were asked to discriminate and reproduce various depth relationships in either drawings or photographs. The findings indicate that reproduction is more difficult than discrimination in both media. When reproducing the depth relationships, overall, it was more difficult to reproduce them in photographs than in drawings. However, certain depth relationships are more easily reproduced in photographs, while others are more easily reproduced in drawings. The results are discussed in terms of how the characteristics of the medium access different aspects of conceptual understanding.

Spatial information is a fundamental aspect of all experience, objects and events must occur within a spatial dimension. However, despite its pervasiveness and importance, there is no one sense, equivalent to vision or hearing, by means of which we perceive such spatial information as size, extension, direction, location and distance. Spatial information seems to be intersensory by its very nature. How spatial information is organized and used as a basis for action becomes an important and difficult issue to consider.

Piaget and Inhelder's (1967) seminal studies of children's concepts of space begin by distinguishing practical knowledge of space, which can be demonstrated by children's ability to move through an environment, from conceptual knowledge of space, which refers to the way spatial information is organized and manipulated in thought. Piaget and Inhelder focused their studies on children's conceptual knowledge of space. Their findings revealed that young children first develop topological concepts of space, which refer to their ability to understand the spatial characteristics of particular objects, and older children begin to demonstrate projective and Euclidean concepts, referring to the ability to appreciate perspective and the relationship between various objects within an environment.

More recently, researchers have questioned these findings and suggest that the developmental differences in children's concepts of space were a result of the techniques used by Piaget and Inhelder to access the children's knowledge (Siegel & Schadler, 1977; Siegel, 1981). The techniques of having children construct maps and models of spatial arrangements are believed to underestimate their knowledge. It is argued that children's practical knowledge of spatial arrangements is a better indication of their conceptual competency.

Liben (1982) has compared preschool children's practical knowledge of a familiar environment with their ability to construct a model of the same environment. Her findings reveal that the children demonstrate greater spatial knowledge when acting in the actual environment than when constructing a model; however, this greater knowledge was still far from being completely accurate. Liben points out that all tasks require that children manipulate what they know about space to some degree, and cautions against drawing inferences about spatial competency from any one task. Instead of attempting to describe children's concepts of space in terms of general competency, Liben suggests that the manipulation of spatial information in various tasks should be the competence of interest. In this way, developmental patterns would be described by their ability to demonstrate spatial understanding in a variety of tasks.

This study is concerned with children's understanding of spatial relationships and the way in which they demonstrate their understanding in drawings and photographs. Sixty children, ages five-, eight-, and eleven-years, participated in this study. All of the children were asked to discriminate and reproduce three types of depth relationships: enclosure, where a larger object is placed directly behind a smaller object; occlusion, where one object is placed in front of and partially obscurring another object; and perspective, where two objects are completely in view but one object is placed behind and at a distance from the other. Half of the children in each of the age groups were randomly assigned to either a Drawing condition, in which the children were asked to discriminate and reproduce line drawings of the three spatial relationships, or a Photographic condition, in which the children were asked to discriminate and reproduce black and white photographs of the same three relationships.

To determine the children's ability to discriminate and identify these three relationships a matching task was used. In this task each child was presented with a standard picture depicting one of the three depth relationships and was asked to match the standard to an identical picture from an array of four pictures. Each child was given nine such tasks, in which each of the three relationships were presented three times using different objects.

In order to determine the children's ability to manipulate and organize spatial information a reproduction task was given to the children approximately one week after the matching task. In this task each child was brought to a large play area where two large containers were located. One of the containers was approximately one foot smaller in height and width than the other. The containers were placed eight feet away from one another. The child was taken to the center of the play area, between the two containers, and was shown a picture depicting the two containers in one of the three depth relationships. The child was then asked to reproduce a picture that was "just like" the one that was presented. After the first attempt at making a reproduction, the child was given the opportunity to compare his or her reproduction with the original and make another reproduction. The child was then asked to choose which reproduction was best. This procedure was repeated for each of the three depth relationships. In the Photographic condition the children were given a Polaroid camera. Prior to the presentation of the photograph each child was given instructions in using the camera and was allowed to take one practice picture. The children in the Drawing condition were provided with a pad of paper and a marker.

The data from the matching task demonstrates the children's ability to discriminate and identify the various spatial relationships at all three age levels and in both the Drawing and Photographic conditions. The mean number of correct matches

are presented in Table 1. While there appears to be an increase in the scores with increasing age, and better performance in the Drawing condition, a three way, repeated measures, analysis of variance (Age by Condition by Type of Relationship) revealed that there were no main effects for age or condition. There was, however, a significant age by condition interaction. Post hoc comparisions indicate that among the five-year-olds, matching pictures was more difficult with the photographs than with the line drawings.

In contrast to the children's ability to discriminate and identify the various spatial relationships, the children's attempts to reproduce them revealed a number of distinctions in their performance. The reproductions were scored accurate or inaccurate by two independent judges. A reliability coefficient of .87 was achieved between the two judges. A three way, repeated measures, analysis of variance (Age by Condition by Type of Relationship) indicated that the number of accurate reproductions increased with age, and that there were significantly more accurate reproductions in the Drawing condition than in the Photographic condition. The data presented in Table 2 show that the difference between the Drawing and Photographic conditions occur among the five- and eight-year-old children, while the eleven-year-olds' performance was equivalent in the two conditions.

The analysis of these data also indicate that the particular type of spatial relationship had an effect on the children's ability to make accurate reproductions, and that this effect varied in the Drawing and Photographic conditions. It can be seen in Table 3 that in the Drawing condition the five- and eight-year- old children produced more accurate reproductions of the enclosure and occlusion relationships than they did of the perspective relationship. In the Photographic condition the five- and eight-year-olds did not produce as many accurate reproductions of enclosure and occlusion relationships, and were most successful in reproducing the perspective relationship.

This study has been concerned with childrens conception of space, however, it seems very difficult to say what such a concept might entail or exactly what it means to have such a concept. The data have shown that the ability to perceive spatial relationships does not ensure the skills necessary to reproduce the same relationships; nor does the ability to reproduce a particular spatial relationship in one medium, such as drawing, ensure the skills necessary to reproduce that relationship in a different medium, such as photography. It seems that finding children's concept of space is a protean task, in that the ways in which spatial information must be manipulated to access the concept,concomitantly alters and changes the concept itself. Understanding children's concept of space requires an account of these variations and changes.

With regard to the data from this study, understanding children's concept of space requires an explanation of the variations in performance in the Drawing and Photographic conditions. One possible explanation is derived from J.J. Gibson (1979) who suggested that photographs contain too much information in contrast to line drawings. Line drawings selectively represent the critical information needed to clearly perceive and understand the spatial relationships. The photographs' greater realism confuse rather than enhance the perception of this information. This explanation could account for the apparent difficulties the children had during the matching task but it does not explain why the reproduction task should be even more difficult than the matching task, nor does it explain why reproducing the perspective relationship was difficult in the Drawing condition but significantly easier in the Photographic condition.

A second possible explanation involves considering the activities of drawing and taking a photograph, and the different kinds of spatial information they require. The chirographic aspect of drawing, while demanding certain motor skills also frees the children from having to utilize precise spatial information when drawing their reproductions. It is possible for the children in this condition to draw an accurate reproduction with only an overview or survey of the critical spatial information. The children did not have to continually examine or move around the containers while making their drawings.

and they did not have to establish a fixed station point between themselves and the containers while making their reproductions. On the other hand, taking a photograph requires in addition to a general overview of the critical spatial information, precise procedural knowledge which would allow the children to move around and examine the containers, and establish a fixed station point before an accurate reproduction could be made.

Distinguishing these activities in this way may serve as a starting point for understanding the difficulties in making accurate reproductions in the Drawing and Photographic conditions. In addition, pointing out the distinctions between these activities could help in specifying different kinds of spatial information entailed in children's concept of space. It is suggested that rather than trying to see through these activities to get a clear understanding of the concept of space, that the manipulations and demands of such activities be attended to and coordinated into our theoretical understanding of what children know about space.

References

Gibson, J. J. The ecological approach to visual perception. Boston: Houghton Mifflin, 1979.

Liben, L. S. Children's large-scale spatial cognition: Is the measure the message? In Robert Cohen (ed.) Children's conceptions of spatial relations. New Directions for child development, San Francisco: Jossey-Bass, Inc. 1982.

Piaget, J. & Inhelder, B. The child's conception of space. New York: Norton, 1967.

Siegel, A. W. The externalization of cognitive maps by children and adults: In search of ways to ask better questions. In L. S. Liben, A. H. Patterson, and N. Newcombe (Eds.) Spatial representation across the life-span. New York: Academic Press, 1981.

Siegel, A. W. & Schadler, M. Young children's cognitive maps of their classroom. Child Development, 1977, 48, 388-394.

Table 1

Mean number of correct discriminations in the matching task presented by age and condition.[a]

Age	Drawing Condition	Photographic Condition
5	7.3	5.7
8	7.8	7.4
11	8.9	8.5

[a] N = 10 in each cell; total N = 60
Maximun score = 9

Table 2

Percentage of accurate reproductions presented by age and condition.[a]

Age	Drawing Condition	Photographic Condition
5	60	50
8	70	56
11	96	93

[a] N = 10 in each cell; total N = 60
Percentage based on 30 reproductions (10Ss x 3 reproductions) per cell

Table 3

Percentage of accurate reproductions presented by age, condition and type of relationship.[a]

	Drawing Condition			Photographic Condition		
Age	Enclosure	Occlusion	Perspective	Enclosure	Occlusion	Perspect
5	80	70	30	40	50	60
8	90	70	50	40	50	80
11	100	100	90	100	90	90

[a] N = 60
Percentage based on 10 reproductions per cell